**CLASS : XII**

**SUBJECT : CHEMISTRY (d and f block elements)**

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| **Sr. No.** | **Knowledge Based** | **Marks** |
| 1. | Write down the electronic configuration of:  (i) Cr3+ (iii) Cu+ (v) Co2+ (vii) Mn2+  (ii) Pm3+ (iv) Ce4+ (vi) Lu2+ (viii) Th4+ | 1 each |
| 2. | Write the electronic configurations of the elements with the atomic numbers 61, 91, 101, and 109. | 3 |
| 3 | What are the characteristics of the transition elements and why are they called transition elements? Which of the *d*-block elements may not be regarded as the transition elements? | 3 |
| 4 | In what way is the electronic configuration of the transition elements different from that of the non transition elements? | 1 |
| 5 | Silver atom has completely filled *d* orbitals (4*d*10) in its ground state.How can you say that it is a transition element? | 1 |
| 6 | What are inner transition elements? Decide which of the following atomic numbers are the atomic numbers of the inner transition elements : 29, 59, 74, 95, 102, 104. | 2 |
| 7 | Why do transition elements show variable oxidation states? | 1 |
| 89 | Why are transition elements named so? | 2 |
| 9 | Write down the number of 3d electrons in each of the following ions: Ti2+, V2+, Cr3+, Mn2+, Fe2+, Fe3+, Co2+, Ni2+ and Cu2+. Indicate how would you expect the five 3d orbitals to be occupied for these hydrated ions (octahedral). | 3 |
| 10 | Compare the general characteristics of the first series of the transition metals with those of the second and third series metals in the respective vertical columns. Give special emphasis on the following points:  (i) electronic configurations (ii) oxidation states (iii) ionisation enthalpies and (iv) atomic sizes. | 4 |
| 11 | Explain briefly how +2 state becomes more and more stable in the first half of the first row transition elements with increasing atomic number? | 2 |
| 12 | Which is a stronger reducing agent Cr2+ or Fe2+ and why ? | 2 |
| 13 | Explain why Cu+ ion is not stable in aqueous solutions? | 2 |
| 14 | What are alloys? Name an important alloy which contains some of the lanthanoid metals. Mention its uses. | 3 |
| 15 | Describe the preparation of potassium dichromate from iron chromite ore. What is the effect of increasing pH on a solution of potassium dichromate? | 3 |
| 16 | Describe the preparation of potassium permanganate. How does the acidified permanganate solution react with  (i) iron(II) ions (ii) SO2 and (iii) oxalic acid?  Write the ionic equations for the reactions. | 4 |
| 17 | Indicate the steps in the preparation of:  (i) K2Cr2O7 from chromite ore. (ii) KMnO4 from pyrolusite ore. | 3 |
| 18 | Compare the chemistry of actinoids with that of the lanthanoids with special reference to:  (i) electronic configuration (iii) oxidation state  (ii) atomic and ionic sizes and (iv) chemical reactivity. | 4 |
| 19 | What are the different oxidation states exhibited by the lanthanoids? | 3 |
| 20 | What is lanthanoid contraction? What are the consequences of lanthanoid contraction? | 3 |
| 21 | What are interstitial compounds? Why are such compounds well known for transition metals? | 2 |
| 22 | Which metal in the first series of transition metals exhibits +1 oxidation state most frequently and why? | 2 |
| 23 | What is lanthanoid contraction? What are the consequences of lanthanoid contraction? | 2 |
| 24 | Which is the last element in the series of the actinoids? Write the electronic configuration of this element. Comment on the possible oxidation state of this element. | 2 |
| 25 | Compare the chemistry of the actinoids with that of lanthanoids with reference to:  (i)electronic configuration (ii) oxidation states and (iii) chemical reactivity. | 2 |
| 26 | Actinoid contraction is greater from element to element than lanthanoid contraction. Why? | 2 |
| 27 | What is lanthanoid contraction? | 2 |
| **S. No.** | **Understanding Based** |  |
| 1. | In the series Sc (*Z* = 21) to Zn (*Z* = 30), the enthalpy of atomisation of zinc is the lowest, i.e., 126 kJ mol–1. Why? | 3 |
| 2. | To what extent do the electronic configurations decide the stability of oxidation states in the first series of the transition elements? Illustrate your answer with examples. | 3 |
| 3 | Why are Mn2+ compounds more stable than Fe2+ towards oxidation to their +3 state? | 3 |
| 4 | Compare the stability of +2 oxidation state for the elements of the first transition series. | 3 |
| 5 | Use Hund’s rule to derive the electronic configuration of Ce3+ ion, and calculate its magnetic moment on the basis of ‘spin-only’ formula. | 3 |
| 6 | Predict which of the following will be coloured in aqueous solution? Ti3+, V3+, Cu+, Sc3+, Mn2+, Fe3+ and Co2+. Give reasons for each. | 3 |
| 7 | How would you account for the irregular variation of ionisation enthalpies (first and second) in the first series of the transition elements? | 2 |
| 8 | How would you account for the following:  (i) Of the *d*4 species, Cr2+ is strongly reducing while manganese(III) is strongly oxidising.  (ii) Cobalt(II) is stable in aqueous solution but in the presence of complexing reagents it is easily oxidised.  (iii) The *d*1 configuration is very unstable in ions. | 3 |
| 9 | Name the oxometal anions of the first series of the transition metals in which the metal exhibits the oxidation state equal to its group number. | 2 |
| 10 | How is the variability in oxidation states of transition metals different from that of the non transition metals? Illustrate with examples. | 2 |
| 11 | Describe the oxidising action of potassium dichromate and write the ionic equations for its reaction with:  (i) iodide (ii) iron(II) solution and (iii) H2S | 2 |
| 12 | The *E* 0(M2+/M) value for copper is positive (+0.34V). What is possiblereason for this? | 2 |
| 13 | Why is the highest oxidation state of a metal exhibited in its oxide or fluoride only? | 2 |
| 14 | Calculate the number of unpaired electrons in the following gaseous ions: Mn3+, Cr3+, V3+ and Ti3+. Which one of these is the most stable in aqueous solution? | 3 |
| 15 | Name the members of the lanthanoid series which exhibit +4 oxidation states and those which exhibit +2 oxidation states. Try to correlate this type of behaviour with the electronic configurations of these elements. | 3 |
| 16 | Give examples and suggest reasons for the following features of the transition metal chemistry:  (i) The lowest oxide of transition metal is basic, the highest is amphoteric/acidic.  (ii) A transition metal exhibits highest oxidation state in oxides and fluorides.  (iii) The highest oxidation state is exhibited in oxoanions of a metal. | 3 |
| 17 | Comment on the statement that elements of the first transition series possess many properties different from those of heavier transition elements. | 3 |
| 18 | Why is La(OH)3 a stronger base than Lu(OH)3 ? | 2 |
| **S. No.** | **Application** |  |
| 1. | What may be the stable oxidation state of the transition element with the following *d* electron configurations in the ground state of their atoms : 3*d*3, 3*d*5, 3*d*8 and 3*d*4? | 3 |
| 2. | Explain giving reasons:  (i) Transition metals and many of their compounds show paramagnetic behaviour.  (ii) The enthalpies of atomisation of the transition metals are high.  (iii) The transition metals generally form coloured compounds.  (iv) Transition metals and their many compounds act as good catalyst. | 3 |
| 3 | For M2+/M and M3+/M2+ systems the *E*V values for some metals are as follows:  Cr2+/Cr -0.9V Cr3/Cr2+ -0.4 V  Mn2+/Mn -1.2V Mn3+/Mn2+ +1.5 V  Fe2+/Fe -0.4V Fe3+/Fe2+ +0.8 V  Use this data to comment upon:  (i) the stability of Fe3+ in acid solution as compared to that of Cr3+ or Mn3+ and  (ii) the ease with which iron can be oxidised as compared to a similar process for either chromium or manganese metal. | 3 |
| 4 | Calculate the magnetic moment of a divalent ion in aqueous solution if its atomic number is 25. | 2 |
| 5 | What can be inferred from the magnetic moment values of the following complex species?  Example Magnetic Moment (BM)  K4[Mn(CN)6) 2.2  [Fe(H2O)6]2+ 5.3 | 2 |
| 6 | Calculate the ‘spin only’ magnetic moment of M2+(aq) ion (*Z* = 27). | 2 |
| 7 | The chemistry of the actinoid elements is not so smooth as that of the lanthanoids. Justify this statement by giving some examples from the oxidation state of these elements. | 2 |
| 8 | The halides of transition elements become more covalent with increasing oxidation state of the metal. Why? | 2 |
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| **S.No.** | **Value Based** |  |
| 1. | Nikhil was watching news on TV. The reporter was reporting about a special drive launched by the Police to curb crimes related to drunken-driving. The news showed some policemen stopping people and asking them to blow air into an instrument. Nikhil asked his father and came to know its rather to test consumption of alcohol   1. What is the instrument being used by Police called? 2. What values are police trying to inculcate? 3. Write the reaction involved in it to detect alcohol? | 3 |
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| **S.No.** | **HOTS** |  |
| 1. | When a brown compound of manganese (A) is treated with HCl it gives a gas (B). The gas taken in excess, reacts with NH3 to give an explosive compound (C). identify the compounds A and B. | 3 |
| 2. | During and experiment it was found that Fe has a higher melting point than Cu. What could be the reason for it? | 2 |
| 3 | [Ti(H2O)]+3 is coloured while [Sc(H2O)6]+3 is colourless. Why? | 2 |